Modeling of Natural Systems  CMSS 6305.001  
Department of Physical and Environmental Sciences  
Spring 2020

A. COURSE INFORMATION
Course number/section:  CMSS 6305.001  
Class meeting time:  T R  2:00pm.-3:15 pm.  
Class location:  BH-202  
Course Website:  bb9.tamucc.edu

B. INSTRUCTOR INFORMATION
Instructor:  Dr. Alexey L Sadovski  
Office location:  CI-338  
Office hours:  T R 12 noon-2:00 PM, F 9:00-10:00 AM  
Telephone:  (361) 825-2477  
e-mail:  Alexey.Sadovski@tamucc.edu  
Appointments:  Appointments also available. Office hours subject to meetings related to other duties on campus. They may change during the semester.

C. COURSE DESCRIPTION
Catalog Course Description
Modeling and analysis of deterministic and stochastic dynamical systems, including investigation of model behavior and stability. Theory will be applied to research natural environmental and biological systems such as multi-species systems, carbon circulation in the biosphere, Nutrients-Phytoplankton-Zooplankton models, etc. Prerequisites: MATH 5315 Statistical Methods in Research I and MATH 5316 Statistical Methods in Research II, or permission of instructor.

Extended Course Description
This course will deal with methods and software to analyze multivariate data, expert information, and mathematical methods of analyzing complex systems. The course begins with the quick review of basic statistics and a short introduction to essential linear algebra concepts. Then students will learn techniques for multivariate data, basic tools for multivariate analysis, among them are: regression in several variables, measuring and testing multivariable distances, principal components, factor analysis, cluster analysis and multidimensional scaling. Students will do analysis and computations of data sets using the R-package, SPSS, and SAS packages.

D. PREREQUISITES AND COREQUISITES
Prerequisites  
MATH 6315 - Statistical Methods in Research I, undergraduate equivalent, or consent of the instructor.
Corequisites
none

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook(s)
none

Optional Textbook(s) or Other References
Will be posted on the Blackboard or handouts given in class.

Supplies
none

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

The core objectives for this course are:
1. To understand philosophy of mathematical modeling
2. To learn and explore an art of modeling
3. To analyze environmental and ecological dynamical systems
4. To understand and analyze stochastic systems of the natural world and their modeling
5. To apply mathematical modeling to real world problems

G. INSTRUCTIONAL METHODS AND ACTIVITIES

The class uses lecture format encouraging student participation and discussion. Problems and data sets for analysis will be giving to students with every chapter or unit that we cover.
• Students will be given a start to use mathematical packages such as MatLab and SPSS.
• Students will analyze and learn interpretation of mathematical modeling and statistical theory by stressing the concepts that are fundamental for a total understanding.
• In the final project students will analyze and learn how to apply the theory to real life problems.
• Meetings will be held in the forms of lecture and discussion seminars and online interactions. Teams of students will be assigned some projects. Midterm evaluation and final exam will be in the form of an assignment-test and/or project with the open-end real life situation.

H. COURSE REQUIREMENTS AND GRADING

All the work done in the class will be part of your final grade. The table below shows the weight of each of the items considered to determine your grade. Assignments will be given with each unit that we cover during the course

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<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tr>
<td>Assignments and topic projects</td>
<td>55%</td>
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Midterm: 20%
Final exam-project: 25%

Grade scale: A: 85-100, B: 70-84, C: 55-69, D: 40-54, F less than 40.

I. COURSE CONTENT/SCHEDULE (tentative)

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Topics</th>
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<tr>
<td></td>
<td>Logistic growth. Fish harvesting.</td>
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<tr>
<td>02/03-02/14</td>
<td>Differential equations. Predator-prey models. Competition models.</td>
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<td>Phase spaces.</td>
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<tr>
<td>03/02-03/13</td>
<td>Partial Differential Equations. Spatial-temporal multi-species models</td>
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<td>03/16-03/27</td>
<td>Spring Break</td>
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<td>03/30-04/10</td>
<td>Epidemics models. Project #2 on epidemics models</td>
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<tr>
<td>04/13-04/24</td>
<td>Markov chains and processes. Stochastic systems in nature.</td>
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<tr>
<td>04/27-05/06</td>
<td>Decision making and optimization models</td>
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<tr>
<td>May 12</td>
<td>Final Exam at 1:45 PM BH-202</td>
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Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

Attendance/Tardiness
Required

Late Work and Make-up Exams
N/A

Extra Credit
N/A

Cell Phone Use
N/A

Laptop Use
Yes

Food in Class
No

Missed Exam
N/A

Participation
K. COLLEGE AND UNIVERSITY POLICIES

- **Academic Integrity (University)**
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. **Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course.** Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar ([http://www.tamucc.edu/academics/calendar/](http://www.tamucc.edu/academics/calendar/)) for the last day to drop a course.
• Grade Appeals (College of Science and Engineering)
As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science and Engineering Grade Appeals webpage at http://sci.tamucc.edu/students/GradeAppeal.html For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

• Disability Services
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

http://disabilityservices.tamucc.edu/

• Statement of Academic Continuity
In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.
L. OTHER INFORMATION

- Academic Advising
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.